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मानक

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“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

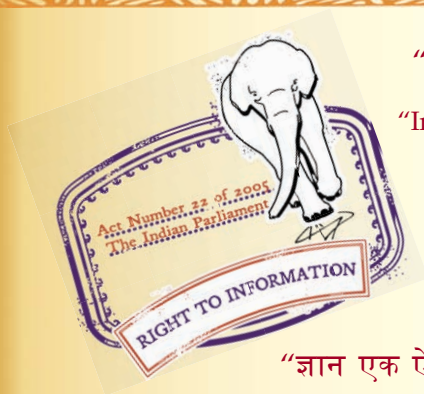
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 2544 (1973): Porcelain post insulators for systems with nominal voltage greater than 1000 V olts [ETD 6: Electrical Insulators and Accessories]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS : 2544 - 1973

(Reaffirmed 1996)

REAFFIRMED

2006

Indian Standard
SPECIFICATION FOR
PORCELAIN POST INSULATORS FOR
SYSTEMS WITH NOMINAL VOLTAGES
GREATER THAN 1 000 VOLTS
(First Revision)

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BUREAU OF INDIAN STANDARDS

MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG

NEW DELHI 110002

AMENDMENT NO. 2 FEBRUARY 1978

TO

IS:2544-1973 SPECIFICATION FOR PORCELAIN
POST INSULATORS FOR SYSTEMS WITH
NOMINAL VOLTAGES GREATER THAN 1 000 VOLTS

(First Revision)

Alterations

(Page 28, Table 6):

*Col 2, fourth entry - Substitute '430'
for '380'.*

*Col 3, third entry - Substitute '320'
for '380'.*

(ETDC 3)

AMENDMENT NO. 3 OCTOBER 1978
TO
IS : 2544-1973 SPECIFICATION FOR PORCELAIN
POST INSULATORS FOR SYSTEMS WITH NOMINAL
VOLTAGES GREATER THAN 1 000 VOLTS
(First Revision)

Alterations

(Page 5, clause 2.8, line 3) — Substitute ' 9.3 ' for ' 9.2 '.

(Page 5, clause 2.9, line 2) — Substitute ' 9.3 ' for ' 9.2 '.

(Page 5, clause 2.10, line 4) — Substitute ' 9.4 or 9.5 ' for ' 9.3 or 9.4 '.

(Page 5, clause 2.11, line 4) — Substitute ' 9.4 or 9.5 ' for ' 9.3 or 9.4 '.

(Page 5, clause 2.12, line 3) — Substitute ' 9.6 ' for ' 9.5 '.

(Page 5, clause 2.13, line 2) — Substitute ' 9.9 ' for ' 9.8 '.

(Page 15, clause 9.3.6, line 3) — Substitute ' [see IS : 2071 (Part II) 1974*] ' for ' (see IS : 2070-1962*) '.

(Page 15, foot-note with ' * ' mark) — Substitute the following for the existing foot-note:

‘ *Methods of high voltage testing: Part II Test procedures (first revision).’

(Page 16, clause 9.4.3, line 5) — Substitute ' [see IS : 2071 (Part II) 1974*] ' for ' (see IS : 2071-1962*) '.

(Page 16, clause 9.5.2, line 3) — Substitute ' [IS : 2071 (Part I) 1974†] ' for ' IS : 2071-1962* '.

(Page 16, clause 9.5.4, line 4) — Substitute ' [see IS : 2071 (Part II) 1974*] ' for ' (see IS : 2070-1962†) '.

(Page 16, foot-notes with ' * ' and ' † ' marks) — Substitute the following for the existing foot-notes:

‘ *Methods of high voltage testing: Part II Test procedures (first revision).’

†Methods of high voltage testing: Part I General definitions and test requirements (first revision).’

(Page 20, clause 9.11, line 3) — Substitute ' IS : 2633-1972* ' for ' IS : 2633-1964* '.

(Page 20, foot-note with ' * ' mark) — Substitute the following for the existing foot-note:

' *Methods of testing uniformity of coating on zinc coated articles (first revision).'

(Page 28, Table 6):

a) Column 2, fourth entry — Substitute ' 430 ' for ' 380 '.

b) Column 3, third entry — Substitute ' 320 ' for ' 380 '.

(Page 32, clause C-2.1, line 2) — Substitute ' IS : 2071 (Part I)-1974* and IS : 2071 (Part II)-1974† ' for ' IS : 2070-1962* '.

(Page 32, clause C-3.1, line 2) — Substitute ' IS : 2071 (Part I)-1974* and IS : 2071 (Part II)-1974† ' for ' IS : 2071-1962† '.

(Page 32, foot-notes with ' * ' and ' † ' marks) — Substitute the following for the existing foot-notes:

' *Methods of high voltage testing: Part I General definitions and test requirements (first revision).'

†Methods of high voltage testing: Part II Test procedures (first revision).'

(ETDC 3)

**AMENDMENT NO.4 OCTOBER 1991
TO
IS 2544 : 1973 SPECIFICATION FOR PORCELAIN POST
INSULATORS FOR SYSTEMS WITH NOMINAL
VOLTAGES GREATER THAN 1 000 V
(*First Revision*)**

(*Page 10, Table 1, col 4, last entry*) — Substitute '460' for '260'.

(*Page 10, Note 2, line 2 and Page 11, Note 2, line 2*) — Substitute 'col 3 and 4' for 'col 2 and 3'.

(*Page 14, clause 9.1.2.4, line 6*) — Substitute 'quantity' for 'quality'.

(*Page 19, clause 9.8.2, line 2*) — Substitute 'bath' for 'path'.

(*Page 21, clause 9.14.2, line 2*) — Substitute '9.13' for '9.12'.

(ETDC 6)

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Indian Standard

SPECIFICATION FOR PORCELAIN POST INSULATORS FOR SYSTEMS WITH NOMINAL VOLTAGES GREATER THAN 1 000 VOLTS

(First Revision)

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(Continued on page 2)

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(Continued from page 1)

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Indian Standard
SPECIFICATION FOR
PORCELAIN POST INSULATORS FOR
SYSTEMS WITH NOMINAL VOLTAGES
GREATER THAN 1 000 VOLTS
(*First Revision*)

0. F O R E W O R D

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 26 July 1973, after the draft finalized by the Electrical Insulators and Accessories Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard was first issued in 1963. This revision has been undertaken with a view to bringing the test values, for power frequency withstand test and impulse voltage withstand test given in Table 1 of this standard, in line with the values specified in IS : 2165-1962* for a given system voltage. The opportunity is also being utilized to rationalize the classification of tests and to include the 5 amendments issued to-date.

0.3 The object of this standard is to define the terms and characteristics of post insulators and post insulator units. It also prescribes the conditions under which the specified values of the characteristics shall be verified. The methods of test and acceptance criteria are also covered.

0.4 The following Indian Standards cover the dimensions of porcelain post insulators and post insulator units.

IS : 5350 Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V:

(Part I)-1970 Indoor post insulators

(Part II)-1969 Outdoor cylindrical post insulators

(Part III)-1971 Outdoor pedestal post insulators

NOTE — In Part II the term cylindrical insulators is intended to cover also insulators of the truncated form.

*Guide for insulation co-ordination. (Since revised).

IS : 2544 - 1973

0.5 Line post insulators are excluded from the scope of the standard as the same have been covered in IS : 731-1971*.

0.6 In the preparation of this standard assistance has been derived from the following:

IEC Pub 168(1964) Tests on indoor and outdoor post insulators for systems with nominal voltages greater than 1 000 V. International Electrotechnical Commission.

BS 3297 : 1960 Specification for high voltage post insulators. British Standards Institution.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard applies to post insulators and post insulator units of ceramic materials for indoor and outdoor service in electrical installations or equipment operating on alternating current with a rated voltage greater than 1 000 Volts and frequency not greater than 100 Hz.

NOTE — The post insulators covered by this standard are generally designed to provide rigid supports for bus-bars, parts of isolators and air-break switches and other conductors in substations, and for similar applications. It does not apply to insulators for supporting overhead transmission lines conductors.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Post Insulator — A post insulator consists of one post insulator unit or an assembly of such units and is intended to give rigid support to a live part which is to be insulated from earth or from another live part.

2.2 Post Insulator Unit — A post insulator unit is a constituent part of a post insulator and consists of a permanent assembly of one or more insulating parts complete with other parts (metallic or non-metallic) designed to facilitate attachment to it.

2.3 Outdoor Post Insulators or Post Insulator Units — Outdoor post insulators or post insulator units are those intended to be subjected in service to the weather (rain, snow, etc).

*Specification for porcelain insulators for overhead power lines with nominal voltage greater than 1 000 V (*second revision*).

†Rules for rounding off numerical values (*revised*).

2.4 Indoor Post Insulators or Post Insulator Units — Indoor post insulators or post insulator units are intended to be installed indoors where they are not subject to excessive condensation.

NOTE — For indoor installations subject to excessive condensation, outdoor insulators or special indoor insulators may be used.

2.5 Lot — All the post insulators of the same type and design manufactured under similar conditions of production, offered for acceptance; a lot may consist of the whole or part of the quantity ordered.

2.6 Flashover — A disruptive discharge, external to the post insulator or post insulator unit, connecting those parts which normally have the operating voltages between them.

2.7 Puncture — A disruptive discharge, passing through the solid insulating parts of a post insulator or post insulator unit.

NOTE — A fragment breaking away from the rim of a shed or damage to the insulator due to the heat of a surface discharge is not considered a puncture.

2.8 Dry Impulse Withstand Voltage — The specified impulse voltage which the post insulator or post insulator unit shall withstand, under the conditions specified in 9.2 without flashover or puncture.

2.9 Fifty-Percent Dry Impulse Flashover Voltage — The impulse voltage which, under the conditions prescribed in 9.2 has a 50 percent probability of producing a flashover on the post insulator or post insulator unit.

2.10 Dry or Wet Power-Frequency Withstand Voltage — The specified power-frequency voltage which the post insulator or post insulator unit shall withstand, dry or wet, under the conditions prescribed in 9.3 or 9.4 for the specified time (one minute) without flashover or puncture.

2.11 Dry or Wet Power-Frequency Flashover Voltage — The arithmetic mean value of the measured power-frequency voltages which cause flashover of the post insulator or post insulator unit under the conditions prescribed in 9.3 or 9.4.

2.12 Mechanical Failing Load — The maximum load which can be reached when a post insulator or post insulator unit is tested under the conditions prescribed in 9.5. It corresponds to the maximum load of a load deflection curve.

2.13 Puncture Voltage — The voltage which, under the conditions prescribed in 9.8 causes puncture.

2.14 Creepage Distance (of a Post Insulator or Post Insulator Unit) — The shortest distance or the sum of the shortest distances along

the contours of the external surfaces of the porcelain insulating parts of the post insulator or post insulator unit between those parts which normally have the operating voltage between them. If high-resistance coatings are applied to parts of the insulator, such coatings shall be considered effective creepage surfaces and the distance over them is included in the creepage distance.

NOTE 1 — The surface resistivity of such high-resistance coatings is usually about 10^9 ohms, but may be as low as 10^4 ohms.

NOTE 2 — If high-resistance coatings are applied to the whole surface of the insulator (the so-called stabilized insulator) the question of surface resistivity and creepage distance should be subject to agreement between the user and the manufacturer.

2.14.1 Protected Creepage Distance — That part of the creepage distance on the illuminated side of the post insulator or post insulator unit which would lie in shadow if light rays were projected on to the insulator in a direction at 90° to the longitudinal axis of the insulator.

2.15 Highest Voltage of a System — The highest rms line-to-line voltage which can be sustained under normal operating conditions at any time and at any point on the system. It excludes temporary voltage variations due to fault conditions and the sudden disconnection of large loads.

2.16 Factor of Earthing — The factor of earthing at a selected location of a three-phase system (generally the point of installation of an equipment), for a given system layout, is the ratio, expressed as a percentage, of the highest rms line-to-earth power-frequency voltage on a sound phase at the selected location during a fault to earth (affecting one or more phases at any point), to the line-to-line rms power-frequency voltage which would be obtained at the selected location with the fault removed.

NOTE 1 — This factor is a pure numerical ratio and characterizes in general terms the earthing conditions of a system as viewed from the selected location, independently of the actual operating values of the voltage at that location.

NOTE 2 — The factors of earthing are calculated from the phase-sequence impedance components of the system as viewed from the selected location, using for the rotating machines the subtransient reactances. The practical rule given in the Note under 2.17.1 results from such a calculation.

NOTE 3 — This factor is used for the choice of the insulation level of the equipment to be installed at a selected location, particularly in the case of systems in which the highest voltage for equipment is 100 kV or more.

2.17 Earthed Neutral System — A system in which the neutral is connected to earth, either solidly, or through a resistance or reactance of low enough value to reduce materially transient oscillations and to give a current sufficient for selective earth fault protection.

2.17.1 A three-phase system with effectively earthed neutral at a given location is a system characterized by a factor of earthing at this point which does not exceed 80 percent.

NOTE — This condition is obtained [approximately] when, for all system configurations, the ratio of zero-sequence reactance to the positive-sequence reactance is less than three and the ratio of zero-sequence resistance to positive-sequence reactance is less than one.

2.17.2 A three-phase system with non-effectively earthing neutral at a given location is a characterizingly a factor of earthing at this point that may exceed 80 percent.

2.18 Type Tests — Tests carried out to prove conformity with the specification. These are intended to prove the general qualities and design of a given type of post insulator or post insulator units.

2.19 Acceptance Tests — Tests carried out on samples taken from the lot for the purpose of acceptance of the lot.

2.20 Routine Tests — Tests carried out on each post insulator or post-insulator unit to check requirements which are likely to vary during production.

3. REFERENCE ATMOSPHERIC CONDITIONS

3.1 Reference atmospheric conditions at which post insulator or post insulator unit characteristics shall be expressed for the purpose of comparison shall be as given below:

Ambient temperature	20°C
Barometric pressure	1 013 millibars
Absolute humidity	11 g of water per cubic metre corresponding to 63 percent relative humidity at 20°C

NOTE 1 — A pressure of 1 013 millibars is equivalent to a pressure of 760 mm of mercury at 0°C. If the height of the barometer is h mm of mercury and the temperature of the mercury is t °C, the atmospheric pressure in millibars is:

$$p = \frac{1\,013\,h}{760} (1 - 1.80 \times 10^{-4} t)$$

NOTE 2 — The Indian Standard reference temperature of 27°C and corresponding humidity have not been specified because of the non-availability of the test voltage values and correction factors for these conditions. These conditions will replace those specified above when the corresponding test voltage values and correction factors are available.

3.2 Tests for the purpose of this standard shall preferably be carried out under conditions of temperature and humidity specified in IS : 196-1966* (that is, a temperature of $27 \pm 2^{\circ}\text{C}$ and relative humidity of 65 ± 2 per cent), and at the prevailing atmospheric pressure. When this is not possible, test may be carried out under conditions naturally obtaining at the time of the test. The barometric pressure, air temperature and humidity shall be recorded for the purpose of corrections. Corrections of test voltages for atmospheric conditions is given in Appendix A.

4. GENERAL REQUIREMENTS

4.1 The porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed.

4.2 Unless otherwise specified, the glaze shall be brown in colour. The glaze shall cover all the exposed porcelain parts of the insulator except those areas which serve as supports during firing or are required to be left unglazed.

4.3 Precautions shall be taken during design and manufacture to avoid the following:

- a) Stresses due to expansion and contraction which may lead to deterioration,
- b) Stress concentration due to direct engagement of the porcelain with the metal fittings,
- c) Retention of water in the recesses of metal fittings, and
- d) Shapes which do not facilitate easy cleaning by normal methods.

4.4 Cement used in the construction of post insulators shall not cause fracture by expansion or loosening by contraction, and proper care shall be taken to locate correctly the individual parts during cementing. The cement shall not give rise to chemical reaction with metal fittings, and its thickness shall be as uniform as possible.

4.5 All ferrous metal parts, except those of stainless steel, shall be hot-dip galvanized and the uniformity of the zinc coating shall satisfy the requirements of IS : 2633-1964†. The parts shall be galvanized after machining. The finished galvanized surface shall be smooth.

NOTE — In view of the scarcity of zinc which is used for galvanizing, other types of anti-corrosion protection, such as aluminizing, may be used subject to agreement between the purchaser and the supplier. It is not possible to give definite specifications for such alternatives at present but these are expected to be included later.

*Atmospheric conditions for testing. (revised)

†Methods of testing weight, thickness and uniformity of coating on hot dipped galvanized articles. (Since revised).

4.6 The threads of the tapped holes in the post insulator metal fittings shall be cut after giving anti-corrosion protection and shall be protected against rust by greasing or other similar means; all other threads shall be cut before giving anti-corrosion protection. The tapped holes shall be suitable for bolts with threads having anti-corrosion protection and shall conform to IS : 4218 (Parts I to VI)*. The effective length of thread shall be not less than the nominal diameter of the bolt.

4.7 The post insulator unit shall be assembled in a suitable jig to ensure the correct positioning of the top and bottom metal fittings relative to one another. The faces of the metal fitting shall be parallel and at right angles to the axis of the insulator and the corresponding holes in the top and the bottom metal fitting shall be in a vertical plane containing the axis of the insulator.

5. CLASSIFICATION

5.1 Post insulator and post insulator units are divided into the following two types according to their construction:

- a) *Type A* — A post insulator or post insulator unit in which the length of the shortest puncture path through solid insulating material is at least equal to half the length of the shortest flashover path through air outside the insulator.
- b) *Type B* — A post insulator or post insulator unit in which the length of the shortest puncture path through solid insulating material is less than half the length of the shortest flashover path through air outside the insulator.

6. STANDARD INSULATION LEVELS

6.1 The standard insulation levels of the post insulator or post insulator unit shall be as given in Tables 1 and 2.

6.2 The power frequency voltages shall be expressed as peak values divided by $\sqrt{2}$. The impulse voltage shall be expressed as peak values.

6.3 The withstand and flashover voltage are referred to the reference atmospheric conditions.

*ISO metric screw threads:

- (Part I) - 1967 Basic and design profiles
- (Part II) - 1967 Pitch diameter combinations
- (Part III) - 1967 Basic dimensions for design profiles
- (Part IV) - 1967 Tolerancing system
- (Part V) - 1967 Tolerances
- (Part VI) - 1967 Limits of sizes for commercial bolts and nuts (diameter range 1 to 39 mm).

TABLE 1 STANDARD INSULATION LEVELS FOR ALL INSULATORS UP TO AND INCLUDING 72.5 kV RATED VOLTAGE AND FOR INSULATORS FOR NON-EFFECTIVELY EARTHED SYSTEMS ABOVE 72.5 kV

(Clauses 0.2, 6.1, 9.2.1, 9.3.2, 9.4.2 and 9.5.3)

HIGHEST SYSTEM VOLTAGE	VISIBLE DISCHARGE TEST	DRY ONE-MINUTE POWER-FREQUENCY WITHSTAND TEST	WET ONE-MINUTE POWER-FREQUENCY WITHSTAND TEST	POWER-FREQUENCY PUNCTURE WITHSTAND TEST ON UNITS	IMPULSE VOLTAGE WITHSTAND TEST
(1)	(2)	(3)	(4)	(5)	(6)
kV (rms)	kV (rms)	kV (rms)	kV (rms)	kV (rms)	kV (peak)
3.6	3	21	21	1.3 times the actual dry flashover voltage of the unit	45
7.2	5.5	27	27		60
12	9	35	35		75
24	18	55	55		125
36	27	75	75		170
52	36	105	105		250
72.5	53	140	140		325
*123	88	230	230		550
145	105	275	275		650
245	154	460	260		1 050

NOTE 1 -- For selection and application of post insulators, see Appendix B of this standard, IS : 2165-1962†, IS : 5350 (Part I)-1970‡, IS : 5350 (Part II)-1969§ and IS : 5350 (Part III)-1971||.

NOTE 2 — The values of dry and wet one-minute power frequency withstand test given in col 2 and 3 relate to indoor and outdoor application respectively.

NOTE 3 — The values of standard insulation levels for 52 kV highest system voltage have been included to cater for the needs of traction and some of the existing power systems in India.

*Even though the highest system voltage of 123 kV is not a standard value in IS : 585-1962¶ a number of older power systems are retaining the nominal system voltage of 110 kV which correspond to the highest system voltage of 123 kV. The test voltages for this highest system voltage are, therefore, given for the benefit of such power systems.

†Guide for insulation co-ordination. (Since revised).

‡Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part I Indoor post insulators.

§Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part II Outdoor cylindrical post insulators. (Since revised).

||Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part III Outdoor pedestal post insulators.

¶Specification for voltages and frequency for ac transmission and distribution systems (revised).

TABLE 2 STANDARD INSULATION LEVELS FOR INSULATORS FOR USE ON EFFECTIVELY EARTHED SYSTEMS ABOVE 72.5 kV

(Clauses 6.1, 9.2.1, 9.3.2, 9.4.2 and 9.5.3)

HIGHEST SYSTEM VOLTAGE	VISIBLE DISCHARGE TEST	DRY ONE-MINUTE POWER-FREQUENCY WITHSTAND TEST	WET ONE-MINUTE POWER-FREQUENCY WITHSTAND TEST	POWER-FREQUENCY PUNCTURE WITHSTAND TEST ON UNITS	IMPULSE VOLTAGE WITHSTAND TEST
(1)	(2)	(3)	(4)	(5)	(6)
kV (rms)	kV (rms)	kV (rms)	kV (rms)	kV (rms)	kV (peak)
*123	88	185	185	1.3 times the actual dry flashover voltage of the unit	450
145	105	230	230		550
245	154	395	395		900
420	266	630	630		1 425
		or 680	or 680		or 1 550

NOTE 1 — For selection and application of post insulators, see Appendix B of this standard, IS : 2165-1962†, IS : 5350 (Part I)-1970‡, IS : 5350 (Part II)-1969§, and IS : 5350 (Part III)-1971||.

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†Guide for insulation co-ordination. (Since revised).

‡Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part I Indoor post insulators.

§Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part II Outdoor cylindrical post insulators. (Since revised).

||Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part III Outdoor pedestal post insulators.

¶Specification for voltages and frequency for ac transmission and distribution systems (revised).

IS : 2544 - 1973

7. MARKING

7.1 Each post insulator or post insulator unit shall be legibly and indelibly marked to show the following:

- a) Name or trade-mark of the manufacturer,
- b) Month and year of manufacture, and
- c) Country of manufacture.

7.1.1 Markings on porcelain shall be printed and shall be applied before firing.

7.2 BIS Certification Marking

The product may also be marked with Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

8. SELECTION OF POST INSULATORS AND POST INSULATOR UNITS

8.1 A few recommendations on the selection and application of post insulators and post insulator units are given in Appendix B.

9. TESTS

9.1 General

9.1.1 *Type Tests* — The following tests shall constitute the type tests:

- a) Visual examination (**9.12**),
- b) Verification of dimensions (**9.7**),
- c) Visible discharge test (**9.2**),
- d) Impulse voltage withstand test (**9.3**),
- e) Dry power-frequency voltage withstand test (**9.4**),
- f) Wet power-frequency voltage withstand test (**9.5**),
- g) Temperature cycle test (**9.8**),
- h) Test for mechanical strength (**9.6**),

- j) Puncture test (for insulators Type B only) (9.9),
- k) Porosity test (9.10), and
- m) Galvanizing test (9.11).

NOTE 1 — For certain insulators, deflection under load may be especially important. When it is agreed that a test for deflection under load is necessary, the test shall be made in accordance with 9.6.6.

NOTE 2 — Type tests are normally made once and unless otherwise agreed to, test certificate giving the results of type tests, made on not less than 2 post insulators and post insulator units identical in all essential details with those to be supplied, are regarded, as evidence of compliance. The tests should be carried out on two samples in the order mentioned below:

- a) *Tests on both insulators*
 - 1) Visual examination (9.12),
 - 2) Verification of dimensions (9.7),
 - 3) Visible discharge test (9.2),
 - 4) Impulse voltage withstand test (9.3),
 - 5) Dry power-frequency voltage withstand test (9.4),
 - 6) Wet power-frequency voltage withstand test (9.5), and
 - 7) Temperature cycle test (9.8).
- b) *Tests on first insulators*
 - 1) Mechanical strength test (9.6), and
 - 2) Porosity test (9.10).
- c) *Tests on second insulators*
 - 1) Puncture test (for insulators type B only) (9.9), and
 - 2) Galvanizing test (9.11).

NOTE 3 — Type tests shall be made and certified by the manufacturer or by an agreed independent authority.

9.1.2 Acceptance Test — The test samples after having withstood the routine tests (9.1.3) shall be subjected to the following acceptance tests in the order indicated below:

- a) Verification of dimensions (9.7),
- b) Temperature cycle test (9.8),
- c) Mechanical strength test (9.6),
- d) Puncture test (9.9),
- e) Porosity test (9.10), and
- f) Galvanizing test (9.11).

9.1.2.1 The number of post insulators or post insulator units to be selected at random from the lot for acceptance tests shall be in accordance with Table 3. If required the additional insulators (9.1.2.3) shall also be selected at random.

TABLE 3 NUMBER OF POST INSULATORS OR POST INSULATOR UNITS TO BE SELECTED

(Clause 9.1.2.1)

Lot Size	NUMBER OF POST INSULATOR UNITS TO BE SELECTED
(1)	(2)
Up to 500	To be agreed between the purchaser and the supplier
501 to 800	6
801 to 1 300	8
1 301 to 3 200	10
3 201 to 8 000	14
8 001 and above	20

9.1.2.2 The insulators selected in accordance with **9.1.2.1** shall be divided into two equal parts and subjected to the applicable tests as indicated below:

Tests (see 9.1.2)

- (a) and (b)
- (c) and (e)
- (d) and (f)

Parts of Samples

- Both parts
- First part
- Second part

9.1.2.3 If only one insulator or metal part fails to comply with any one of the acceptance tests, a new quantity equal to twice the first quantity shall be subjected to retesting. The retesting shall comprise the test in which failure occurred preceded by those tests which may be considered to have influenced the results of the original tests. If no failure occurs, the lot shall be accepted.

NOTE — Where failure in the galvanizing test is due to a mechanical load in excess of the routine test load in a previous test, the retest may be carried out on unassembled metal parts.

9.1.2.4 If two or more insulators or metal parts fail to comply with any of the acceptance tests or if any failure occurs on insulators or metal parts subjected to retesting as described in **9.1.2.3**, the complete lot shall be withdrawn for further examination by the manufacturers after which the lot or any part thereof may be resubmitted for tests. The number then selected shall be three times the first quantity chosen for test. This retesting shall comprise the test in which the failure occurred preceded by those tests which may be considered to have influenced the results of the original tests. If any failure occurs, the lot shall be rejected.

9.1.2.5 No part of the lot withdrawn as described in 9.1.2.4 shall constitute part of any other lot submitted for the first time.

9.1.3 Routine Tests — The following shall be carried out as routine tests on each post insulator or post insulator unit:

- a) Visual examination (9.12),
- b) Routine electrical test (9.13), and
- c) Routine Mechanical test (9.14).

9.2 Visible Discharge Test (Power-Frequency Voltage) — The test room shall be darkened and a period of five minutes shall be allowed for the observer to become accustomed to darkness. A power-frequency test voltage of the specified value given in Table 1 or Table 2 shall be applied between the two metal fittings of the post insulator (*see also* Appendix C) and maintained at this value for 5 minutes. During this time observations shall be made and there shall be no sign of visible corona.

9.3 Impulse Voltage Withstand Test

9.3.1 The post insulator or post insulator unit shall be tested dry under the conditions prescribed in Appendix C.

9.3.2 The impulse generator shall be adjusted to produce a standard 1·2/50 impulse wave of peak value equal to impulse withstand voltage specified in Tables 1 or 2, corrected for atmospheric conditions in accordance with Appendix A.

9.3.3 Five such impulse voltage waves shall be applied to the insulator. If there is no flashover or puncture, the insulator shall be considered to have passed the test. If during the application of these five waves puncture occurs or if there is more than one flashover, the insulator shall be considered to have failed to comply with the standard. If only one flashover occurs, a new series of ten impulse waves shall be applied. The insulator shall be considered to have passed this test only if during this new series of tests there is no flashover or puncture.

9.3.4 The post insulator or post insulator unit shall be capable of passing the impulse voltage withstand test with voltages of both positive and negative polarity. However, when it is evident which polarity will give lower breakdown voltage, it shall suffice to test with that polarity.

9.3.5 The insulator shall not be damaged by these tests, but slight marks on the surface of the insulating parts or chipping of the cement or other material used for assembly shall be permitted.

9.3.6 To provide information when specially requested, the 50 percent impulse flashover voltage for positive and negative polarities may be determined by a suitable procedure (*see* IS : 2070-1962*).

*Method of impulse voltage testing. (Since revised).

IS : 2544 - 1973

9.3.6.1 The impulse flashover voltages to be recorded shall be the positive and negative 50 percent impulse flashover voltage as measured above and corrected in accordance with Appendix A.

9.4 Dry Power-Frequency Voltage Withstand Test

9.4.1 The post insulator or post insulator unit shall be tested dry under the conditions prescribed in Appendix C.

9.4.2 The one-minute withstand test voltage to be applied to the insulator shall be the dry one-minute power-frequency withstand voltage specified in Table 1 or 2 adjusted for the atmospheric conditions at the time of test (*see* Appendix A).

9.4.3 A voltage of about 75 percent of the test voltage as determined in **9.4.2** shall be applied and then increased gradually to reach the test voltage in a time not less than five seconds. The test voltage shall be maintained at this value for one minute. Flashover or puncture shall not occur (*see* IS : 2071-1962*).

9.4.4 The dry flashover voltage of the insulator may be determined by increasing the voltage gradually from about 75 percent of the dry one-minute withstand voltage to reach the flashover voltage in not less than five seconds. The dry flashover voltage shall be the arithmetic mean of five consecutive readings and the value, after correction to standard atmospheric conditions (*see* Appendix A), shall be recorded.

9.5 Wet Power-Frequency Voltage Withstand Test

9.5.1 The post insulator or post insulator unit shall be arranged as prescribed in Appendix C.

9.5.2 Before the commencement of the test, the insulator shall be exposed to the artificial rain produced in accordance with **3.3** of IS : 2071-1962* for at least one minute before application of voltage and then throughout the test.

9.5.3 The test voltage to be applied to the insulator shall be the wet power-frequency withstand voltage specified in Table 1 or 2 adjusted for atmospheric conditions at the time of test (*see* Appendix A).

9.5.4 A voltage of about 75 percent of the test voltage as determined in **9.5.3** shall be applied and then increased gradually to reach the test voltage in a time not less than five seconds. The test voltage shall be maintained at this value for one-minute (*see* IS : 2070-1962†). The insulator shall not flashover or puncture during the application of the test voltage.

*Methods of high voltage testing. (Since revised).

†Method of impulse voltage testing. (Since revised).

9.5.5 To provide information when specially requested, the wet flashover voltage of the insulator may be determined by increasing the voltage gradually from about 75 percent of the wet withstand voltage to reach the flashover voltage in not less than five seconds. The flashover voltage shall be the arithmetic mean of five consecutive readings and the value, after correction to standard atmospheric conditions (*see* Appendix A), shall be recorded.

9.6 Test for Mechanical Strength

9.6.1 The post insulator or post insulator unit shall be attached to the mounting face of the testing machine by its normal method of mounting.

9.6.2 The load shall be applied gradually, starting from a value not greater than half the specified failing load, and shall be increased until the specified failing load is reached. The insulator passes the test if the specified failing load is reached without any failure. For the value of specified failing load, reference shall be made to IS : 5350 (Part II)-1970*.

9.6.3 An insulator which has been tested to its specified failing load shall not subsequently be used in service.

9.6.4 To provide information when specially requested, the load may be increased until the failing load as defined in **2.12** is reached and the value recorded.

9.6.5 The test for mechanical strength of a post insulator or post insulator unit shall consist of one of the three tests specified in **9.6.5.1** to **9.6.5.3**. Unless otherwise agreed the test shall be the bending test.

9.6.5.1 Bending test — The load shall be applied to the free end of the post insulator unit. The direction of loading shall pass through the axis of the insulator and shall be at right angles to it.

NOTE — This test may be carried out on the complete post insulator, or in the case of multi-unit stacks, on the individual unit. Where the stack contains only one type of unit, an extension piece shall be provided to enable the load to be applied at a distance above the mounting plate equal to the height of the complete post insulator. Where a stack contains more than one type of units, each type shall be tested with an extension piece to enable the load to be applied at a distance from the unit corresponding to its position of maximum stressing in the stack.

9.6.5.2 Torsion test — The post insulator or post insulator unit shall be subjected to a torsional load avoiding all bending moment.

9.6.5.3 Tensile or compressive test — The post insulator or post insulator unit shall be subjected to a tensile or compressive load along its axis.

*Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V: Part II Outdoor cylindrical post insulators. (Since revised).

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9.6.6 Test for Deflection Under Load — This test is not normally required except when rigidity and small deflections are important. When made, this test is subject to agreement between the purchaser and the manufacturer.

9.6.6.1 The complete post insulator shall be subjected to a bending load as described in 9.6.5.1. The deflection shall be measured at the point at which the load is applied and as the load is increased the deflections shall be recorded when it reaches 20 percent and 50 percent of the specified minimum failing load. By special agreement, additional measurements of deflection may also be made at other loads up to 80 percent of the specified minimum failing load.

9.7 Verification of Dimensions

9.7.1 It shall be verified that the post insulator or post insulator unit is in accordance with the relevant drawings particularly as regards any dimensions to which special tolerances apply (for example, height) and details affecting interchangeability (for example, number of bolts and bolt circle diameter).

9.7.2 Unless otherwise specified, a tolerance of:

$$\pm (0.04 d + 1.5) \text{ mm when } d \leq 300 \text{ mm}$$

$$\pm (0.03 d + 6) \text{ mm when } d > 300 \text{ mm}$$

is allowed on all dimensions for which special tolerances do not apply (d being the dimensions in millimetres).

9.7.3 The dimensions of post insulators or post insulator units are covered in IS : 5350 (Part I)-1970*, IS : 5350 (Part II)-1969† and IS : 5350 (Part III)-1971‡.

9.8 Temperature Cycle Test

9.8.1 In the case of multi-unit post insulators, the test shall be made on individual post insulator units. The insulator shall be with its fixed metal parts. It shall be quickly and completely immersed in a water-bath maintained at a temperature of $t^{\circ}\text{C}$ given in Table 4 above that of the cold water and left submerged for a period T min (*see Note*). It shall then be withdrawn and quickly immersed, without being placed in

*Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part I Indoor post insulators.

†Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part II Outdoor cylindrical post insulators. (Since revised).

‡Dimensions of indoor and outdoor porcelain post insulators and post insulator units for system with nominal voltages greater than 1 000 V : Part III Outdoor pedestal post insulators.

an intermediate container, in a bath of cold water for the same period of T min.

NOTE—The period T in minutes is given by the formula $T = 15 + 0.7 M$ or 30 min whichever is the shorter time, where M is the mass of the insulator in kg.

TABLE 4 TEMPERATURE DIFFERENCE t deg C

VOLUME, $D^3 L$ (1) m^3	TEMPERATURE DIFFERENCE t deg C FOR THICKNESS IN mm					
	Up to 23	Over 23 Up to 26	Over 26 Up to 32	Over 32 Up to 36	Over 36 Up to 43	Over 43
	(2)	(3)	(4)	(5)	(6)	(7)
Up to 0.164	60	55	50	45	40	35
Over 0.164 up to 0.410	55	55	50	45	40	35
Over 0.410 „ „ 0.655	50	50	50	45	40	35
Over 0.655 „ „ 0.900	45	45	45	45	40	35
Over 0.900 „ „ 1.150	40	40	40	40	40	35
Over 1.150	35	35	35	35	35	35

D = the greatest external diameter of the insulator.

L = the height of the insulator.

NOTE—The thickness shall be the greatest thickness of the insulator defined as the diameter of the biggest circle which can be inscribed in the outline of a section through the axis of the insulator.

9.8.2 The heating and cooling cycle shall be performed three times in succession. The time taken to transfer the insulator from one path to the other shall be as short as possible and shall not exceed 30 seconds. The quantity of water in the test tank shall be large enough not to cause a temperature variation of more than 5 deg C in the water, when the insulator is immersed.

9.8.3 After the completion of immersion, the insulator shall be examined to verify that the insulating parts have not cracked, nor the fittings loosened and that the glaze is undamaged. Insulator of Type B shall afterwards pass the power-frequency electrical routine test given in 9.13.

9.8.3.1 Insulator of Type A for which the electrical test is not applicable, shall afterwards pass the mechanical routine test given in 9.14.

9.9 Power-Frequency Puncture Withstand Test

9.9.1 This test shall be applied only to post insulators or post insulator units of Type B [see 5.1 (b)]. The insulator shall be tested under the conditions prescribed in Appendix C.

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9.9.2 The insulators, after having been cleaned and dried, shall be completely immersed in a tank containing a suitable insulating medium to prevent surface discharges on them. If the tank be made of metal, its dimensions shall be such that the shortest distance between any part of the insulator and side of the tank is not less than 1.5 times the diameter of the largest insulator shed. The immersion medium shall be at about room temperature.

9.9.3 The test voltage shall be applied between those parts which normally have the operating voltage between them. During immersion in the insulating medium, precautions shall be taken to avoid air pockets under the sheds of the insulator.

9.9.4 The voltage shall be increased rapidly to the specified dry one-minute power-frequency test voltage and then steadily increased at a rate of about 1 000 v/s until the puncture withstand voltage is reached. No puncture shall occur at this voltage for the minimum time necessary to measure it.

9.9.5 To provide information when specially requested the voltage may then be raised until puncture occurs and the puncture voltage noted for information.

NOTE — If the test installation does not permit puncture to be obtained, the test may be stopped at 1.5 times the specified minimum puncture voltage.

9.10 Porosity Test

9.10.1 Porcelain fragments from the insulator or, by agreement, from representative pieces of porcelain fired adjacent to them shall be immersed in a one percent alcohol solution of fuchsin (1 g fuchsin in 100 g methylated spirit) under a pressure of not less than 15×10^6 pascals for a time such that the product of the test duration in hours and the test pressure in pascals is not less than 180×10^6 .

9.10.2 The fragments shall then be removed from the solution, washed, dried and again broken.

9.10.3 Examination with the naked eye of the freshly broken surfaces shall not reveal any dye penetration. Penetration into small cracks formed during the initial breaking shall be neglected.

9.11 Galvanizing Test — The uniformity of zinc coating of the galvanized metal fittings of the insulator shall comply with the requirements given in IS : 2633-1964* (see also Note under 4.5).

*Methods of testing weight, thickness and uniformity of coating on hot dipped galvanized articles. (Since revised).

9.12 Visual Examination

9.12.1 A visual examination shall be made on each insulator. The colour of the insulator shall approximate to the colour specified on the drawing. Some variation in the colour shade is permitted and shall not justify rejection of the insulator. The insulator shall be free from physical distortion of shape within tolerances specified.

9.12.1.1 The areas specified as glazed on the drawing shall be covered by a smooth hard glaze free from cracks and other defects prejudicial to satisfactory performance in service.

9.12.1.2 Out of those areas specified as glazed on the drawing, the total area not covered by glaze shall not exceed:

$$1 + \frac{DF}{2\,000} \text{ cm}^2$$

Also the area of any single glaze defect shall not exceed:

$$0.5 + \frac{DF}{20\,000} \text{ cm}^2$$

where

D is the greatest diameter of the insulator in cm, and

F is the creepage distance of the insulator in cm.

9.13 Routine Electrical Test

9.13.1 Unless otherwise agreed to, this test applies to post insulator unit of Type B.

9.13.2 Post insulator unit shall be subjected to the power-frequency voltage applied across the parts normally subjected to the electrical stress in service.

9.13.3 The test voltage shall be such as to produce frequent flashover (every few seconds). The voltage shall be maintained for a minimum period of 5 min or if failures occur for 5 min after the last punctured piece has been removed. Insulators which are damaged during the test shall be rejected. Streamer pattern formed during electrical tests may be observable, but it shall not disqualify the insulator for acceptance.

9.14 Routine Mechanical Test

9.14.1 Every post insulator or post insulator unit shall be subjected to a tensile or bending test at a load not less than 30 percent of the specified tensile or bending failing load of the insulator or unit. The load shall be maintained for at least three seconds without damage to the insulator or loosening of fittings.

9.14.2 In case of Type B insulators, this test shall precede the test given in 9.12.

APPENDIX A

(Clauses 3.2, 9.3.2, 9.3.6.1, 9.4.2, 9.4.4, 9.5.3 and 9.5.5)

CORRECTION OF TEST VOLTAGES FOR ATMOSPHERIC CONDITIONS

A-1. GENERAL

A-1.1 Variations in barometric pressure and in humidity of the atmosphere cause variations in the electric strength of the air and hence also in the withstand and flashover voltage of insulators exposed to the air; underoil flashover and puncture strength, however, are not significantly affected by these changes.

A-2. CORRECTION FACTORS

A-2.1 When the atmospheric conditions in the neighbourhood of the insulator during the test differ from the reference conditions, adjustment should be made to certain of the test voltages by the application of the following correction factors in accordance with Table 5:

a) Correction factor for air density d :

$$d = \frac{0.289 p}{273 + t} \quad (\text{where } d \text{ lies between } 0.95 \text{ and } 1.05)$$

where

p = atmospheric pressure in millibars, and

t = temperature in °C.

For a wider range of density and for higher accuracy, instead of d the factor k shall be used as under. The values of k corresponding to factor d are given below:

d	k
0.70	0.72
0.75	0.77
0.80	0.82
0.85	0.86
0.90	0.91
0.95	0.95
1.00	1.00
1.05	1.05
1.10	1.09
1.15	1.13

TABLE 5 CORRECTION OF VOLTAGES FOR ATMOSPHERIC CONDITIONS

(Clause A-2.1)

TEST		CLAUSe	ADJUSTMENT REQUIRED
(1)	(2)	(3)	
Impulse voltage withstand test	9.3	Voltage applied shall be the appropriate value specified in Table 1 or Table 2 multiplied by k and divided by h	
Impulse voltage flashover test	9.3.6	Measured voltage shall be divided by k and multiplied by h	
Dry power-frequency voltage withstand test	9.4	Voltage applied shall be the appropriate value specified in Table 1 or Table 2 multiplied by k and divided by h	
Dry power-frequency voltage flashover test	9.4.4	Measured voltage shall be divided by k and multiplied by h	
Wet power-frequency voltage withstand test	9.5	Voltage applied shall be the appropriate value specified in Table 1 or Table 2 multiplied by k	
Wet power-frequency voltage flashover test	9.5.5	Measured voltage shall be divided by k	
Power-frequency puncture withstand test	9.9	No adjustment required	

- b) Correction factor for humidity (h) : Fig. 1 gives the absolute humidity values for wet and dry bulb temperatures (when the velocity of air over the wet bulb exceeds 3 m/s) for the standard atmospheric pressure of 1 013 millibars. For better accuracy, a correction should be applied to absolute humidity value obtained from Fig. 1 for any deviation of ambient atmospheric pressure from the standard value of 1 013 millibars. This correction should be obtained from Fig. 2 as follows:

Locate the point corresponding to the deviation of ambient atmospheric pressure from 1 013 millibars on the left hand side of Fig. 2B and join it with right hand side top corner by a straight line. Then locate the point on the curve in Fig. 2A corresponding to be observed value of the difference of dry and wet bulb temperatures. Draw a vertical line through this point to intersect the straight line

drawn in Fig. 2B. Read the correction to be applied to humidity from the right hand side of Fig. 2B corresponding to the point of intersection. This correction is positive for a positive deviation and negative for a negative deviation, from the standard atmospheric pressure.

For the corrected value of absolute humidity thus obtained, the correction factor h in Table 5 shall be determined from Fig. 3.

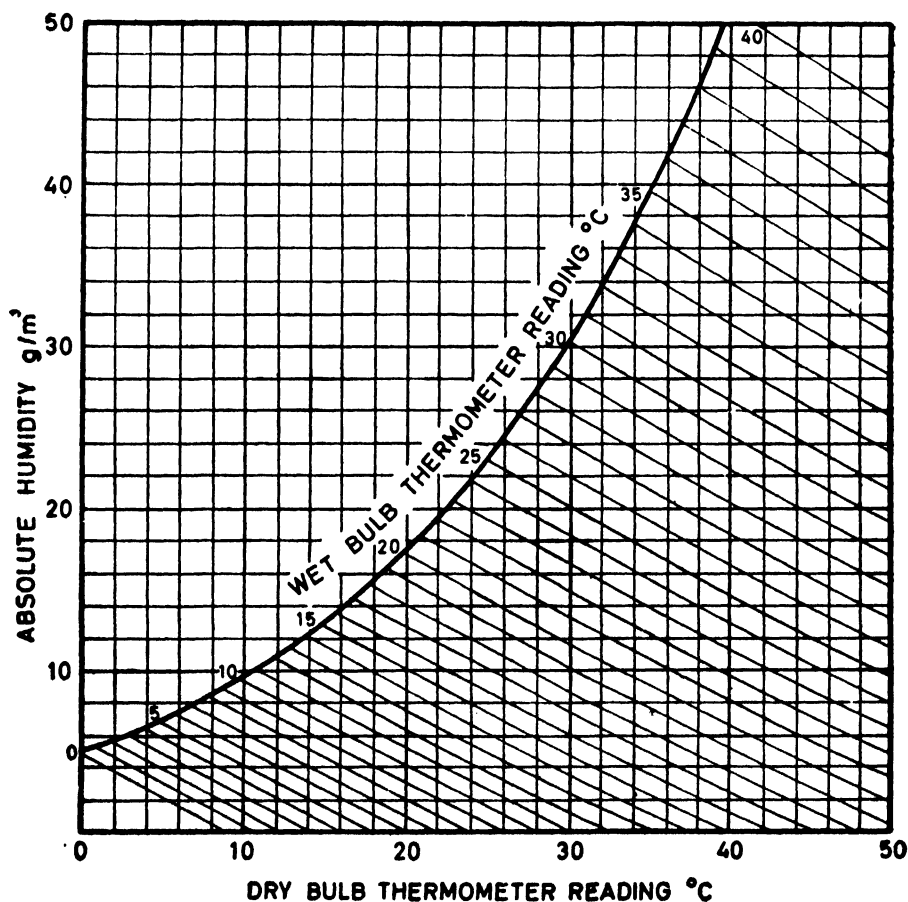


FIG. 1 DETERMINATION OF ABSOLUTE HUMIDITY

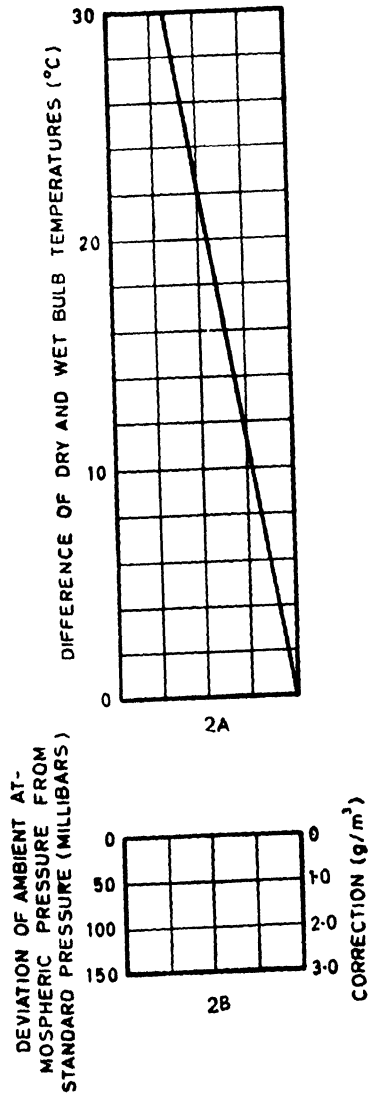
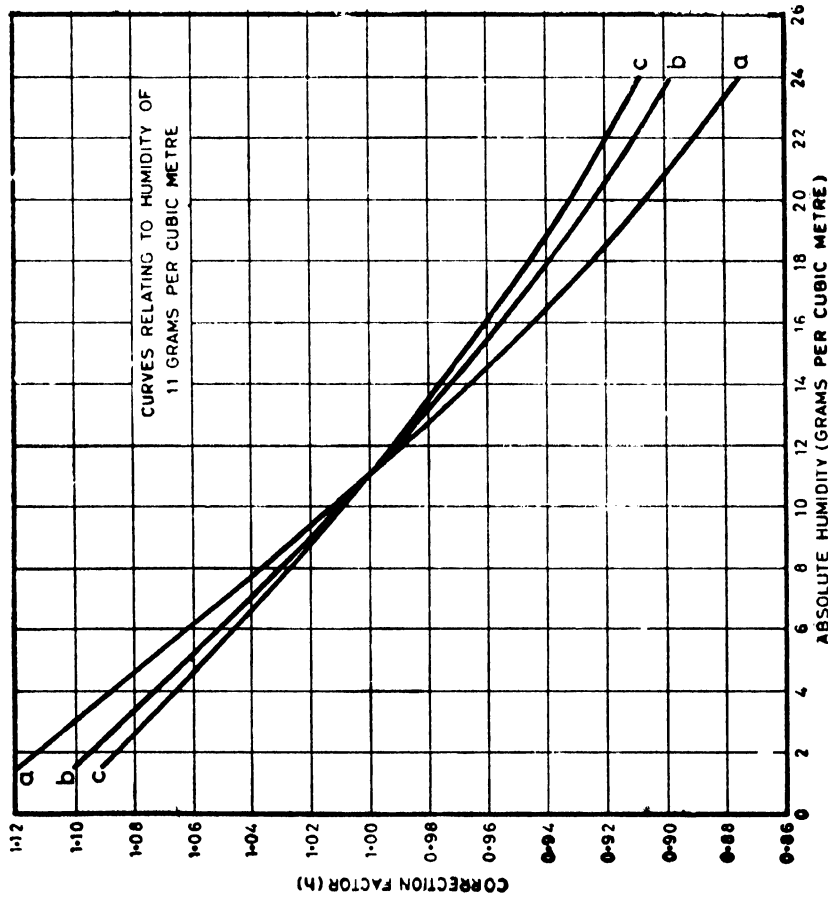


FIG. 2 CORRECTION TO ABSOLUTE HUMIDITY FOR VARIATION IN PRESSURE



'Note - Curve a applies to power-frequency tests at approximately 50 Hz. Curve b applies to positive impulse tests. Curve c applies to negative impulse tests.' Fig. 3 HUMIDITY CORRECTION FACTOR

APPENDIX B

(Tables 1 and 2, and Clause 8.1)

SELECTION OF POST INSULATOR AND POST INSULATOR UNIT

B-1. GENERAL

B-1.0 Factors governing the selection of post insulator and post insulator units include the following:

- a) System voltage,
- b) System earthing,
- c) Insulation levels,
- d) Mechanical strength,
- e) Degree of exposure to atmospheric pollution,
- f) Altitude of the installation,
- g) Ambient air temperature, and
- h) Conditions of installation.

B-1.1 System Voltage — Post insulators or post insulator units are suitable for operation on system where under normal working conditions, the system voltage does not exceed the highest system voltage values given in Tables 1 and 2.

B-1.2 System Earthing

B-1.2.0 The usual conditions of the system neutral is one of **B-1.2.1** to **B-1.2.4**.

B-1.2.1 Isolated Neutral System — A system which has no intentional connection to earth except through indicating, measuring or protective devices of very high impedance.

B-1.2.2 Resonant Earthed System (System Earthed at One or More Points Through Arc-Suppression Coils) — A system earthed through a reactor, the reactance being of such value that during a single line-to-earth fault, the power-frequency inductive current passed by this reactor essentially neutralizes the power-frequency capacitance component of the earth-fault current. On such a system, it is the intention that the majority of line-to-earth faults shall be self-clearing without interruption of the supply. Line-to-earth faults which are not self-clearing are usually either cleared by automatic disconnection or by manual disconnection but not allowed to persist for many hours.

B-1.2.3 Effectively Earthed Neutral System — See 2.17.1.

B-1.2.4 Non-effectively Earthed Neutral System — See 2.17.2.

B-1.3 Insulation Levels — Post insulators or post insulator units complying with this specification and satisfying the test voltages given in Tables 1 and 2 are suitable for the system earthing conditions given in B-1.2.

B-1.4 Mechanical Strength — The mechanical tests specified in the standard are intended to indicate the strength of the post insulator under the bending, torsion, tension or compression loads. The purchaser should satisfy himself that these strengths are adequate when service loads, which may be a combination of any of these type of loads, and their rate of application are taken into consideration.

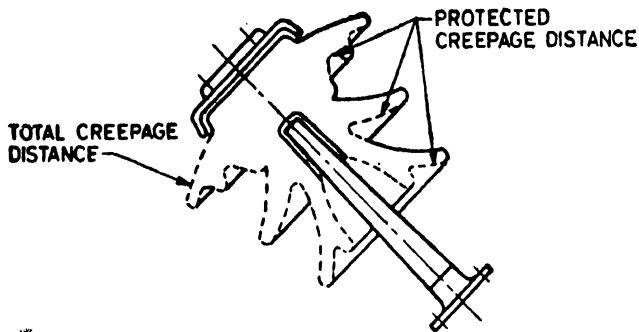
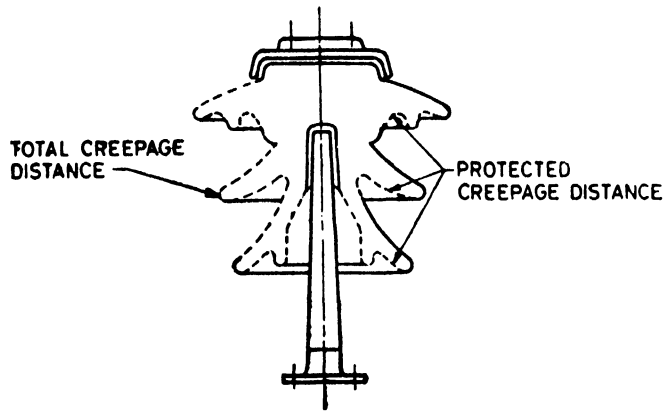
B-1.5 Degree of Exposure to Atmospheric Pollution

B-1.5.1 The degree of exposure to the atmosphere determines the selection of the type of post insulator. Post insulator may have the minimum creepage distance given in Table 6. To make a selection, it is necessary to assess the degree of atmospheric pollution likely to occur at site where it is intended to use the post insulator.

The minimum creepage distances recommended for moderately polluted atmospheres are given in col 2 of Table 6, and those for heavily polluted atmospheres in col 3 and 4. Minimum protected creepage distances (see Fig. 4) are given for highest system voltage of 36 kV and above under these conditions.

TABLE 6 RECOMMENDED MINIMUM CREEPAGE DISTANCES

HIGHEST SYSTEM VOLTAGE	NORMALLY POLLUTED ATMOSPHERES (TOTAL)	HEAVY POLLUTED ATMOSPHERES	
		Total	Protected
(1) kV	(2) mm	(3) mm	(4) mm
3.6	75	130	—
7.2	130	230	—
12	230	380	—
24	380	560	—
36	580	840	420
72	1 100	1 700	850
123	1 850	2 800	1 400
145	2 250	3 400	1 700
245	3 800	5 600	2 800
420	6 480	9 660	4 830



NOTE — These sketches are only illustrations for total creepage and protected creepage distances and the same should not be mistaken for standard configurations.

FIG. 4 POST INSULATOR CREEPAGE DISTANCE

B-1.5.2 Precise definitions of normally and heavily polluted atmospheres cannot be given, since the performance of the insulator will depend not only on the rate of deposition of solid matter, but also on the nature of the deposits and the prevalence of conditions of high humidity. Experience in the area surrounding the site is the best guide but, in the case of localized industrial pollution, for example, chemical fumes, cement dust, etc, the conditions and exposure at the site itself should be considered. In the case of soluble deposit such as salt, regard should also be given to the degree of certainty with which rainfall may be relied upon to act as a washing agent.

B-1.5.2.1 In making the selection, consideration should also be given to the frequency with which the equipment may be withdrawn from service for cleaning without undue risk to the maintenance of supplies. When pollution has been only slightly more than normal, post insulators having the normal creepage distances give excellent service when the frequency of cleaning has been adjusted to the prevailing conditions. Post insulators or post insulator units having longer creepage distance will give less risk of flashover for longer periods between cleaning or artificial washing than those having the normal creepage distance. Where, therefore, opportunities for cleaning are restricted or where heavy salt deposits may occur in a short time, insulators with the higher creepage distance should be considered. In the most severe conditions, however, even the post insulators will require frequent cleaning or washing to give reasonable immunity from surface flashover, and this factor should be taken into account in any selection of sites for outdoor equipment where marine or industrial pollution, normally, is expected to be severe.

B-1.6 Altitude of the Installation — If the altitude of the site exceeds 1 000 m, a larger insulator may be required to ensure that the required test voltage would be obtained under service conditions. The test voltages at normal attitudes as given in Tables 1 and 2 should then be multiplied by the following factor:

$$\text{For altitude } X \text{ metres } 1 + 0.01 \left[\frac{X - 1\,000}{100} \right]$$

NOTE — The altitude correction factor amounts to an increase of one percent in the test voltage for every 100 m in excess of 1 000 m above sea level.

B-1.7 Ambient Air Temperature — Post insulators and post insulator units complying with this standard are suitable for operation in the following ambient air temperatures:

- | | |
|---|------|
| a) Maximum ambient air temperature | 45°C |
| b) Maximum daily average ambient air temperature | 35°C |
| c) Maximum yearly average ambient air temperature | 30°C |

Special provisions may have to be made for other ambient air temperatures.

B-1.8 Conditions of Installation — In an outdoor installation the effective clearance distance between a conductor and earth may be reduced by settling of a bird upon the apparatus. When this cannot be prevented, particularly at the lower voltages, a post insulator having a higher voltage rating than the normal may be desirable or other provisions may be made.

APPENDIX C

(*Clauses 9.2, 9.3.1, 9.4.1, 9.5.1 and 9.9.1*)

HIGH VOLTAGE TESTS

C-1. ARRANGEMENT OF POST INSULATORS AND POST INSULATOR UNITS

C-1.1 For high voltage tests, the post insulator or post insulator unit shall be mounted vertically upright on a horizontal earthed metal support, consisting of a channel section with the flanges pointing downwards. The earthed metal support shall have a width of nearly equal to the diameter of the mounting face of the insulator and a length at least equal to twice the height of the insulator under test and shall be placed at least one metre above the ground. A conductor maintained in the horizontal plane perpendicular to the earthed support shall be attached to the other end of the post insulator or post insulator unit.

The length of the conductor shall be at least equal to 1.5 times the height of the insulator and it shall extend at least one metre on each side of the insulator axis. The diameter of the conductor shall be 12 mm or between 2 and 3 percent of the height of the insulator, whichever is greater.

C-1.1.1 The test voltage shall be applied between the conductor and the earthed support, the high voltage connection being made at one end of the conductor.

C-1.1.2 During the test no other object shall be nearer to the post insulator or the post insulator unit than one metre or 1.5 times the height of the insulator, whichever is greater.

NOTE 1 — Difficulties may be met in complying with the above large insulators and very high voltages. In such cases the method of mounting shall be the subject of agreement between manufacturer and purchaser bearing in mind that the electric field should correspond as far as practicable to service conditions.

NOTE 2 — When so agreed, tests may also be made under conditions reproducing service conditions as closely as possible taking account of all factors which may influence flashover voltage. Under these conditions, the characteristics may differ from the values measured using the standard methods of mounting.

IS : 2544 - 1973

C-1.2 The post insulator or post insulator unit shall be clean and dry and in thermal equilibrium with its surroundings. Any device considered by the manufacturer as a necessary adjunct to the post insulators shall be fitted for high voltage tests; other devices such as arcing horns used for system protection shall be removed or their spacing increased.

C-1.3 Time Intervals Between Flashovers — The time intervals between consecutive flashovers shall be sufficient to avoid effects from the previous application of voltage in flashover or withstand tests.

C-2. IMPULSE TESTS

C-2.1 The impulse tests shall be made in accordance with IS : 2070- 1962*.

C-3. POWER-FREQUENCY TESTS

C-3.1 The power-frequency tests shall be made in accordance with IS : 2071-1962†.

C-3.1.1 The transformer test circuit shall be such that when the test object is short-circuited at the test voltage, the current is not less than 0.1 A if dry tests are to be made, and not less than 0.5 A if wet tests are to be made.

C-4. EXCESSIVE HUMIDITY

C-4.1 Precautions shall be taken to avoid condensation on the surface of the insulator, especially when the relative humidity is high. For example, the insulator shall be maintained at the ambient temperature of the test location for sufficient time for equilibrium to be reached before the test commences. Except by agreement between the manufacturer and the purchaser, tests shall not be made if the relative humidity exceeds 85 percent.

*Method of impulse voltage testing. (Since revised)

†Methods of high voltage testing. (Since revised).

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